

DOCUMENT NO. 5

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NEXT REVIEW DATE: _____

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21 June 1954

MEMORANDUM FOR: The Record

SUBJECT :

Project Monitor

1. Time and Place of Meeting: May 26

2. Attendance:

APD

APD

3. Purpose: The purpose of the meeting was to more clearly define the mutual interests of APD and _____ so that work could be initiated.

4. Discussion: The subject matter of mutual interest between APD and _____ was grouped under the eight following headings.

Infrared Detectors
Infrared Sources
Image Converters and Infrared Sensitive Phosphors
Atmospheric Windows for Long Distance Transmission of
Infrared
Time Delay Devices
Power Sources
Power Storage
Infrared Triggering Systems

5. Infrared Detectors

a. Three types of photo-conductive cells are available for infrared detection. They are lead sulfide, lead telluride, and lead selenide. Lead sulfide shows the greatest sensitivity of the three cells responding to the range of approximately 2 to 3.5 microns at room temperature. The range and sensitivity of the cell may be extended by cooling with liquid air. Lead telluride cells must be cooled by liquid air for practical use. Lead selenide has a low sensitivity but a wide spectral range being sensitive up to 6.0 microns at room temperature. The lead sulfide cell is the most significant of the three for practical application.

b. The possibilities of employing a photo-magneto te electric effect on a semiconductor, known as the Kikoin effect, as an infrared detector have not yet been fully evaluated. Visualizing the x, y, z axes superimposed on a semiconductor crystal, luminous or higher frequency radiant

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energy along the x axis coupled with magnetic flux along the y axis results in a potential along the z axis. Infrared energy along the x axis has a quenching effect on the potential. Both germanium and cadmium sulfide have been employed as the semiconductor with this effect.

c. Photomultiplier tubes may also be used as detectors.

6. Infrared Sources

a. The tungsten lamp is the most efficient source of infrared radiation from the standpoint of power economy. However, it does not respond well to electrical modulation and therefore, prefers a mechanical system for modulation. A cesium vapor lamp source can be modulated electrically but is limited to radiant energy output in the near infrared region where a photomultiplier tube must be employed as a detector.

b. A semiconductor may be used as an electrical shutter system for modulation of another infrared source or it may be used directly as a low power infrared source. In the latter use a semiconductor such as a germanium wafer takes the shape of a surface barrier transistor, the infrared radiation emitting from the point source as formed at the indium-germanium contact. The germanium may be shaped to act as a lens for an appropriate optical system. More than one junction may be made on one crystal, each junction serving as a point source. The maximum power input to each junction is approximately 5 to 8 watts. As germanium is opaque to radiation shorter than 1.8 microns, no visible or near infrared is emitted and consequently emission starts at 1.8 microns. Each germanium point source may be modulated independently.

7. Image Converters and Infrared Sensitive Phosphors

A transistor oscillator may have application as a silent high voltage source for image conversion tubes. Infrared sensitive phosphors may be applicable to infrared detection devices and viewers without image converter tubes.

8. Atmospheric Windows for Long Distance Transmission of Infrared

Due to the infrared absorption spectra of water vapor and carbon dioxide, the transparency of the atmosphere near the ground to infrared radiation is a function of wavelength. Infrared communication over distances greater than several hundred yards will require transmission through one of the atmospheric windows regardless of power output from the transmitter. These windows are relatively sharply defined and appear as follows:

2.0 to 2.5 microns	-	poor
3.5 to 4.1 microns	-	good
4.5 to 5.0 microns	-	poor
8.0 to 12.0 microns	-	good

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Transmission in the near infrared below 1.0 microns will depend on weather conditions to a considerable extent. The criteria of visibility may be used to judge ranges.

9. Time Delay Devices

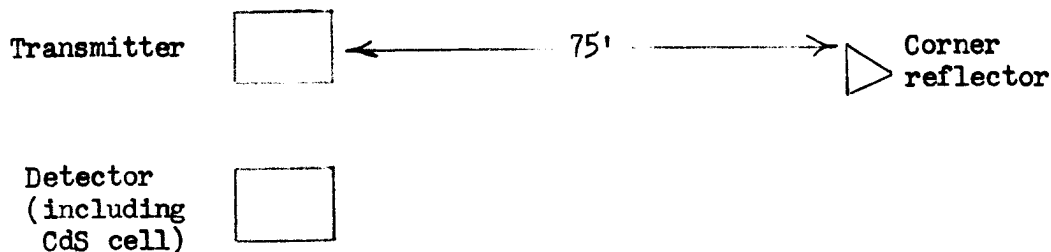
In this field, two ideas employing sources of radioactivity in combination with photoconductive cadmium sulfide cells have been proposed. They are stated in the proposal. The APD requirement for an accurate temperature insensitive time delay from ten minutes to several months was reviewed and the need for a pocket size instrument priced at less than \$10 was emphasized.

10. Infrared Triggering Systems

a. It was decided that the [] be started on the construction of a prototype infrared barrier system using CdS. The proposed specifications are as follows.

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1) Diagram of System



2) Range: 75 feet

3) Life in Operation: (not specified)

4) Size and Weight: as small and light as possible

5) Description

(a) It is proposed that a tungsten source be used in conjunction with XRX-30 filter in the transmitter. The transmitter beam should be 5° in width.

(b) The detector will consist of a CdS ^{cell} source followed by an A.C. amplifier which operates a relay when the beam is broken by a moving object such as a man walking. A collimating optical system will be used to exclude as much background light as possible when operating during daylight (beamwidth of 5° or less).

11. Power Sources

[] is interested in applying the

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Kikoin effect to a "solar battery" type of power supply. They have also developed a unique method of manufacturing very thin electro-chemical batteries permitting the possibility of perhaps manufacturing the battery as the case of the instrument.

12. Power Storage

Only well known power storage systems such as a capacitor and electro-chemical ~~infrared barrier~~ cells were suggested.

13. Conclusion

It was concluded that [] would make a paper survey of the state of the art under the above headings, in which he would include the work of his own organization, that of [] and in addition, all information which is obtainable from the library sources at his disposal. Work will be started by [] on the infrared triggering system.

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14. Action

a. Attempt to obtain an ASTIA clearance for [] so that he may use its facilities.

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b. Forward one corner reflector and XRX-30 and XRX-55 filter material to [] for use in the outlined switching equipment.

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Distribution:

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